

Application Serial No. 10/583,880
Reply to Office Action of April 13, 2010

PATENT
Docket: CU-4890

Amendments to the Claims

The listing of claims presented below replaces all prior versions, and listings, of claims in the application.

Listing of claims:

1 - 56. (cancelled)

57. (new) A method for producing a volume hologram, comprising the steps of:

preparing a photosensitive composition for volume hologram recording, comprising a photopolymerizable compound as a refractive index modulation component, a photopolymerization initiator and a sensitizing dye which increases the sensitivity of the photopolymerization initiator with respect to a wavelength in the visible region,

forming a hologram recording portion comprising the photosensitive composition on a transparent substrate,

providing an original plate of hologram on a back surface of the hologram recording portion, and

performing interference exposure by applying a reference light having a predetermined volume hologram recording wavelength from the front side of the hologram recording portion to record a volume hologram,

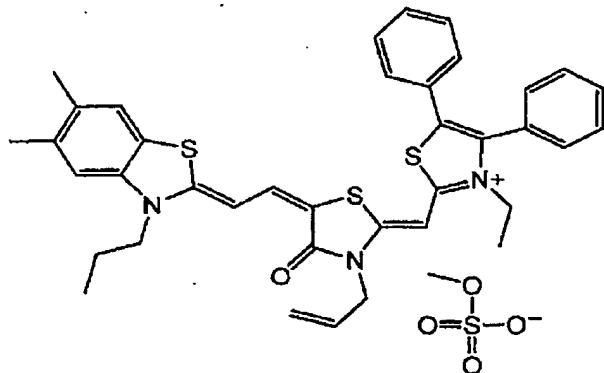
wherein the sensitizing dye is a compound selected from the following compounds (1) and (2); and

wherein the volume hologram recording wavelength is set to deviate from the maximum absorption wavelength of the sensitizing dye by 14 nm or more in the region of 630 nm to 670 nm:

Compound (1):

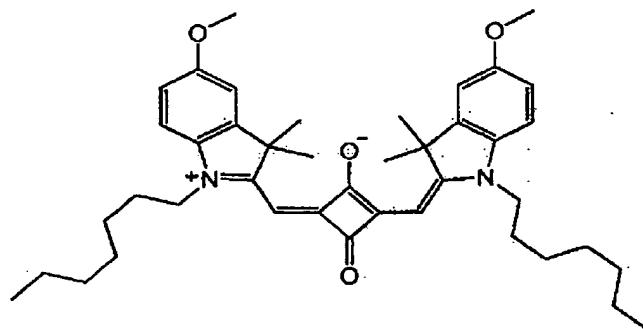
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(chemical name: 2-[[3-allyl-5-[2-(5,6-dimethyl-3-propyl-2(3H)-benzothiazolylidene) ethylidene] -4-oxo-2-thiazolidinylidene]methyl]-3-ethyl-4,5-diphenylthiazolium methylsulfate);

Compound (2):



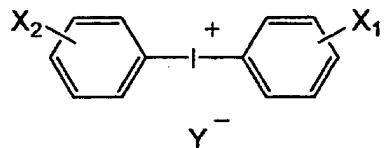
(chemical name: 1-heptyl-2-[3-(1-heptyl-5-methoxy-3,3-dimethyl-1,3-dihydro-indole-2-ilidenemethyl)-2-hydroxy-4-oxo-2-cyclobutenylenemethyl]-5-methoxy-3,3-dimethyl-3H-indolium inner salt).

58. (new) A method of producing a volume hologram according to Claim 57, wherein the photopolymerization initiator is a compound containing diaryliodonium skeleton represented by the following general formula (2):

General formula (2):

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wherein, each of "X₁" and "X₂" is independently an alkyl group having 1 to 20 carbons, halogen or an alkoxy group having 1 to 20 carbons; and "Y" is a monovalent anion.

59. (new) A method of producing a volume hologram according to Claim 57, wherein the photosensitive composition for volume hologram recording further contains a binder resin and/or a thermosetting compound.

60. (new) A method of producing a volume hologram according to Claim 57, wherein the photopolymerizable compound is at least one kind selected from the group consisting of a photoradical polymerizable compound and a photocationic polymerizable compound.

61. (new) A method of producing a volume hologram according to Claim 57, wherein the photosensitive composition for volume hologram recording further contains a second refractive index modulation component having a different refractive index from that of the photopolymerizable compound.

62. (new) A method of producing a volume hologram according to Claim 57, wherein a volume hologram having a diffraction efficiency of 80% or more is obtained.

63. (new) A method for producing a volume hologram, comprising the steps of:
 preparing a photosensitive composition for volume hologram recording,
 comprising a photopolymerizable compound as a refractive index modulation component, a photopolymerization initiator and a sensitizing dye which increases the sensitivity of the photopolymerization initiator with respect to a wavelength in the visible region,
 forming a hologram recording portion comprising the photosensitive composition on a transparent substrate,
 providing an original plate of hologram on a back surface of the hologram

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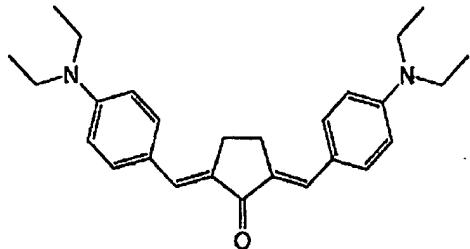
recording portion, and

performing interference exposure by applying a reference light having a predetermined volume hologram recording wavelength from the front side of the hologram recording portion to record a volume hologram,

wherein the sensitizing dye is a compound selected from the following compounds (3) and (4); and

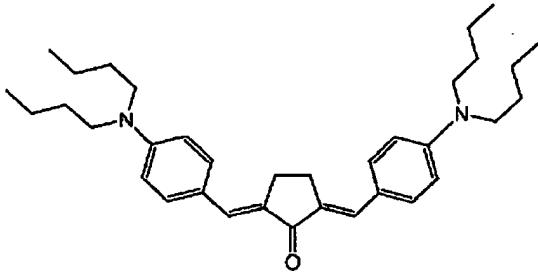
wherein the volume hologram recording wavelength is set to deviate from the maximum absorption wavelength of the sensitizing dye by 14 nm or more in the region of 514 nm to 560 nm:

compound (3):



(chemical name: 2,5-bis(4-diethylaminobenzylidene)cyclopentanone);

compound (4):



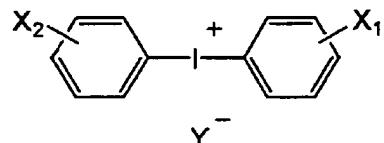
(chemical name: 2,5-bis(4-dibutylaminobenzylidene) cyclopentanone).

64. (new) A method of producing a volume hologram according to Claim 63, wherein the photopolymerization initiator is a compound containing diaryliodonium skeleton represented by the following general formula (2):

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General formula (2):



wherein, each of "X₁" and "X₂" is independently an alkyl group having 1 to 20 carbons, halogen or an alkoxy group having 1 to 20 carbons; and "Y" is a monovalent anion.

65. (new) A method of producing a volume hologram according to Claim 63, wherein the photosensitive composition for volume hologram recording further contains a binder resin and/or a thermosetting compound.

66. (new) A method of producing a volume hologram according to Claim 63, wherein the photopolymerizable compound is at least one kind selected from the group consisting of a photoradical polymerizable compound and a photocationic polymerizable compound.

67. (new) A method of producing a volume hologram according to Claim 63, wherein the photosensitive composition for volume hologram recording further contains a second refractive index modulation component having a different refractive index from that of the photopolymerizable compound.

68. (new) A method of producing a volume hologram according to Claim 63, wherein a volume hologram having a diffraction efficiency of 80% or more is obtained.

69. (new) A method for producing a volume hologram, comprising the steps of:
preparing a photosensitive composition for volume hologram recording,
comprising a photopolymerizable compound as a refractive index modulation component, a photopolymerization initiator and a sensitizing dye which increases the sensitivity of the photopolymerization initiator with respect to a wavelength in the visible region,
forming a hologram recording portion comprising the photosensitive

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composition on a transparent substrate,

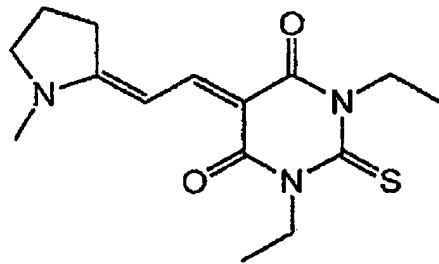
providing an original plate of hologram on a back surface of the hologram recording portion, and

performing interference exposure by applying a reference light having a predetermined volume hologram recording wavelength from the front side of the hologram recording portion to record a volume hologram,

wherein the sensitizing dye is a compound selected from the following compounds (5) and (6); and

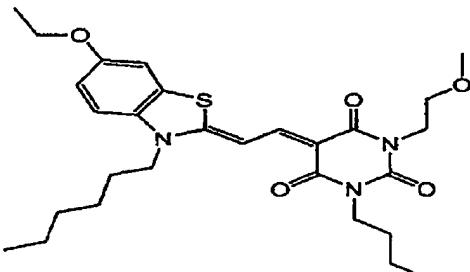
wherein the volume hologram recording wavelength is set to deviate from the maximum absorption wavelength of the sensitizing dye by 14 nm or more in the region of 420 nm to 488 nm:

compound (5):



(chemical name: 1,3-diethyl-5-[2-(1-methyl-pyrrolidine-2-ylidene)-ethylidene]-2-thioxo-dihydro-pyrimidine-4,6-dione);

compound (6):



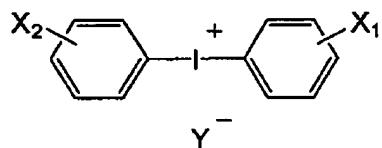
(chemical name: 1-butyl-5-[2-(6-ethoxy-3-hexyl-3H-benzothiazole-2-ylidene)-ethylidene]-3-(2-methoxy-ethyl)-pyrimidine-2,4,6-trione).

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70. (new) A method of producing a volume hologram according to Claim 69, wherein the photopolymerization initiator is a compound containing diaryliodonium skeleton represented by the following general formula (2):

General formula (2):



wherein, each of "X₁" and "X₂" is independently an alkyl group having 1 to 20 carbons, halogen or an alkoxy group having 1 to 20 carbons; and "Y⁻" is a monovalent anion.

71. (new) A method of producing a volume hologram according to Claim 69, wherein the photosensitive composition for volume hologram recording further contains a binder resin and/or a thermosetting compound.

72. (new) A method of producing a volume hologram according to Claim 69, wherein the photopolymerizable compound is at least one kind selected from the group consisting of a photoradical polymerizable compound and a photocationic polymerizable compound.

73. (new) A method of producing a volume hologram according to Claim 69, wherein the photosensitive composition for volume hologram recording further contains a second refractive index modulation component having a different refractive index from that of the photopolymerizable compound.

74. (new) A method of producing a volume hologram according to Claim 69, wherein a volume hologram having a diffraction efficiency of 80% or more is obtained.